IFW AF/1754

PTO/SB/21 (02-04)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/683,267
Filing Date	12/06/2001
First Named Inventor	Duncan
Art Unit	1754
Examiner Name	Lish
Attorney Docket Number	AL.US.9

Total Number of Pages in This Submission

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Return receipt postcard

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Phillip E. Decker
Signature	Phillip E. Decker
Date	05/11/2004

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Phillip E. Decker		
Signature	Phillip E. Decker	Date	05/11/2004

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 165.00

Complete if Known	
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METHOD OF PAYMENT *(check all that apply)*

[ ] Check [X] Credit card [ ] Money Order [ ] Other [ ] None

[ ] Deposit Account:

Deposit Account Number

Deposit Account Name

The Director is authorized to: *(check all that apply)*

[X] Charge fee(s) indicated below [X] Credit any overpayments

[X] Charge any additional fee(s) or any underpayment of fee(s)

[ ] Charge fee(s) indicated below, **except for the filing fee** to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims		Fee from below	Fee Paid
Total Claims		-20** =	X	=
Independent Claims		- 3** =	X	=
Multiple Dependent				=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	165
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 165

SUBMITTED BY

(Complete *(if applicable)*)

Name (Print/Type)	Phillip E. Decker	Registration No. (Attorney/Agent)	39,163	Telephone	603-766-1910
Signature	Phillip E. Decker			Date	05/11/2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Joanna L. Duncan, Christopher R. McLarnon, and Francis R. Alix	Examiner: Peter Lish
Serial No.: 09/683,267	
Confirmation No.: 3355	
Filed: 12/06/2001	Group Art Unit: 1754
For: NOx, Hg, AND SO_2 REMOVAL USING AMMONIA	

Commissioner for Patents
P.O. Box 1450
Arlington, VA 22313-1450

APPEAL BRIEF
37 CFR §1.192

1. Real Party in Interest. The real party in interest is the assignee of this application, Powerspan Corp., the inventors' employer.

2. Related Appeals and Interferences. None.

3. Status of Claims. Claims 1 – 4 and 6 – 16 are pending, and are appealed.

4. Status of Amendments. There have been no amendments filed subsequent to the Notice of Appeal.

CERTIFICATE OF MAILING

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Signature: Phillip E. Decker

5. Summary of Invention. The present invention is directed to a process for removing SO_2, NO, and NO_2 from a gas stream that does not require the addition of a catalyst, chlorine, or ozone, occurs at a relatively high pH, and does not result in ammonia slip. A process that satisfies these needs comprises the steps of oxidizing NO to NO_2 with an oxidizing means resulting in a mole ratio of SO_2 to NO_2 of at least 2.5 to 1 **60** [para. 0015 – 0026], followed by scrubbing SO_2, NO, and NO_2 from the flue gas stream with an ammonia scrubbing solution having a pH between six and eight **62** [para. 0027 – 0041], and removing any ammonia aerosols generated by the scrubbing steps with an aerosol removal means **64** [para. 0042].

6. Issue.

Whether claims 1 – 4 and 6 – 16 are unpatentable under 35 U.S.C. §103(a) over Aoki et al. (U.S. Patent No. 5,041,271), taken with Alix et al. (U.S. Patent No. 5,871,703) taken with Senjo et al. (U.S. Patent No. 4,035,470).

7. Grouping of Claims.

Claim 1, as amended, represents the pending claims.

8. Arguments.

a. *The Office erred in suggesting that the SOx to NOx ratio of 5:1 taught by Aoki is relevant to Applicants' SO_2 to NO_2 ratio of at least 2.5:1 of Claim 1.*

Applicants had amended claim 1, according to the Office's advice in their telephone interview of 7/22/2003, to add the SO_2 to NO_2 limitation found in former Claim 5 into Claim 1. [Telephone Interview Summary, 7/23/2003, page 2, lines 5 – 10.] After this amendment, the Office once again rejected Claim 1, saying, "It is additionally taught by Aoki et al. that the flue gas being treated contains, on average, a ratio of SOx to NOx of 5 to 1. Therefore, it is expected that after oxidation treatment, even at the highest rate of conversion, the gas will have a ratio of SO_2 to NO_2 of at least 2.5 to 1." [Office action mailed 12/12/2003, page 2, lines 8 – 10.]

Applicants disagree with the Office's conclusion. The 5:1 ratio in Aoki is merely the average SOx to NOx concentration resulting from burning coal, and reflects inlet conditions. In

contrast, the 2.5:1 ratio in Claim 1 of the present application is a ratio required for the Applicants' process to work, and reflects conditions after the oxidation step. [Application, para. 0016]

This interpretation is supported in the Aoki patent, col. 2, lines 17 – 23, Fig. 2, and Fig. 5, which says,

> **FIG. 2 is a typical chart showing variations in the SOx and NOx concentrations in coal combustion waste gas. The SOx concentration has variations of about +/- 100 ppm with respect to an average value of 1500 ppm, while the NOx concentration has variations of about +/- 20 ppm with respect to an average value of 300 ppm.**

Dividing the SOx concentration of 1500 ppm by the NOx concentration of 300 ppm results in the 5:1 ratio.

Furthermore, the Office may be incorrectly assuming that all the SOx is SO_2 and all the NOx is NO_2. This is not the case.

Aoki in the '271 patent defines SOx as "sulfur oxides" and NOx and "nitrogen oxides." [col. 3, lines 60- 61] It is well known in the art that use of the subscript "x" can mean any species of the two elements, and implies nothing about their relative concentration. Furthermore, Aoki did not restrict this definition, or suggest relative concentrations, anywhere in the '271 patent. Aoki's use of the terms SOx and NOx are therefore consistent with the usual meaning that is known in the art.

The Applicants, in contrast, are quite specific about which species they are acting on in each of the pending claims. By simple algebra, it is entirely possible to come up with concentrations that satisfy the claim 1 requirement of "resulting in a mole ratio of SO_2 to NO_2 of at least 2.5 to 1" and yet fall outside Aoki's teaching of a SOx to NOx ratio of 5 to 1. The two ratios are not mathematically dependent on each other. Therefore, the Office has made a conclusion with respect to Aoki that has no support in the record and is logically incorrect. The Office has not made a prima facie case of obvious with respect to the Aoki patent. Therefore, it should be removed as a reference against the present application.

b. *The Office erred in suggesting it would have been obvious to substitute the dielectric barrier discharge apparatus of Alix for the electron beam apparatus of Aoki because the Office gave insufficient weight to the Declaration Traversing Rejection.*

The Declaration Traversing Rejection under Rule 132, filed 8/26/2003, set forth facts, as opposed to legal conclusions, that tend to show the non-obviousness of the present invention. Such declarations may be used to explain the technical differences between the claimed invention and the prior art, and an examiner may refer to it in determining whether a claim is obvious or not. Ex parte Franklin, 41 USPQ 43 (Pat. Off. Bd. App. 1938). The Declaration points out the particular reasons why one would not substitute the e-beam of Aoki with the dielectric barrier discharge apparatus of Alix. To summarize, compared to using a dielectric barrier discharge ("DBD") reactor, using e-beam is very an inefficient process, the apparatus is not economical, and there is no evidence that e-beam has any affect on Hg.

The first major difference is that e-beam produces much more highly energetic electrons than DBD, specifically 1,000 to 1,000,000 eV for e-beam compared to about 5 eV for DBD. [Declaration Traversing Rejection, para. 9] The result is that much of the SOx is oxidized to SO_3 instead of SO_2, which is a needless waste of energy, among other things. The second difference is that e-beams must be created in a vacuum, whereas DBD does not. Third, e-beam causes a radiation hazard that must be protected against using cement walls and the like. [Aoki, Fig. 7, and col. 2, line 59 to col. 3, line 17]

i. Applicants assert that there is no suggestion or motivation to combine the two references. Furthermore, the Declaration is evidence that the Aoki patent teaches away from the combination because it is economically undesirable, and may be inoperative because e-beam converts too much SO_2 to SO_3 to achieve the minimum 2.5 to 1 ratio required in the present invention, in which case the desired NO_2 removal would not be achievable.

The Office replied that, "the rejection requires the substitution of the barrier discharge oxidation method of Alix et al for the electron beam method of Aoki et al. Therefore, the argument was unpersuasive." [Office action mailed 12/12/2003, page 2, lines 12 - 13.]

Applicants reply that the Office's argument assumes its conclusion. The Applicant has supplied evidence that the e-beam of Aoki should not be substituted. Therefore, the e-beam apparatus of Aoki could not be substituted for the dielectric barrier discharge apparatus of Alix

to perform the same oxidizing step in Claim 1 of the present application, and it is therefore non-obvious.

ii. Relevant to Claims 11 – 16, the Office also said it was not persuaded by the Declarant's argument related to how e-beam should not be used for a system that oxidizes Hg. Particularly, the Office says, "Applicant argues that the use of the electron beam oxidation method on a gas containing mercury may result in the formation of radicals which may disturb the process. Applicant fails to show evidence that mercury in the flue gas will result in a negative effect on the oxidation process, and it is therefore expected that the mercury will be oxidized, as is shown in the art (see references to Alix et al.)" [Office action mailed 12/12/2003, page 2, lines 14 – 18]

Applicants reply that evidence was presented in the form of the above-mentioned Declaration, which was sworn to by an expert in the field. The assertions were supported by references cited in footnotes. The Office is requiring the Applicants to supply further evidence that may not exist. On the contrary, it is the responsibility of the Office to make the prima facie case, which it has not done on this point. Therefore, the e-beam apparatus of Aoki should not be substituted for the dielectric barrier discharge apparatus of Alix to perform the same oxidizing step in Claim 11 of the present application, and it is therefore non-obvious.

c. *The Office erred in suggesting that it would have been obvious to substitute the wet ESP taught by Alix for the dry ESP of Aoki because the Office gave insufficient weight to the Declaration Traversing Rejection, and because the Office relied on unsubstantiated general knowledge.*

As stated above, the Applicants assert that they gave sufficient evidence to rebut the Office's in the Declaration Traversing Rejection, para. 10. The wet ESP is well known to provide superior collection of ultra-fine particles and aerosols of 1 micron in size and smaller, when compared to a dry ESP. The reason why a dry ESP is less effective is that the resistance of the layer of particles on the collecting plate reduces the ability to transfer power into the ESP. In a wet ESP there is no particle layer on the collecting plate. Therefore, resistance is reduced, and more power can be applied, and the collection of fine particles and aerosols is improved. Using a wet ESP also prevents re-entrainment of particles, which is a significant shortcoming of dry

ESPs. In fact, the superior performance of the wet ESP is vital to the present invention. A dry ESP would not work.

However, the Office maintained the rejection on the ground that, "the wet ESP is known to achieve the same effect as the dry ESP..." [Office action of 12/12/2003, page 3, line 2] This uncited and unsubstantiated statement by the Office is not true. If it were true, no one would go through the added expense to make a wet ESP when a dry ESP would do the same thing. Unfortunately, the Applicants' cannot rebut general statements of knowledge unsupported by evidence. The Applicants' therefore suggest that their Declaration provides sufficient evidence to overcome the Office's assertion on this matter. Therefore, one cannot substitute the wet ESP in Alix for the dry ESP in Aoki, and therefore Claims 1 and 11 are not obvious.

Respectfully submitted,

Reg. No. 39,163
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Date: April 23, 2003

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9. Appendix: The Claims on Appeal.

1. A process for removing SO_2, NO, and NO_2 from a gas stream comprising the steps of

a. oxidizing at least a portion of NO in a gas stream to NO_2 with an oxidizing means resulting in a mole ratio of SO_2 to NO_2 of at least 2.5 to 1, followed by

b. scrubbing at least a portion of SO_2, NO, and NO_2 from the gas stream with a scrubbing solution

comprising ammonia, and

having a pH between 6 and 8, and

c. removing at least a portion of any ammonia aerosols generated from the scrubbing step from the gas stream with an aerosol removal means.

2. The process of claim 1, wherein said oxidizing means is an electrical discharge reactor.

3. The process of claim 2, wherein said electrical discharge reactor is a dielectric barrier discharge reactor.

4. The process of claim 3, further comprising the step of oxidizing at least a portion of the NO to HNO_3 with said dielectric barrier discharge reactor.

6. The process of claim 1, wherein said oxidizing step is adapted to result in a mole ratio of SO_2 to NO_2 of at least four to one.

7. The process of claim 1, said scrubbing solution

comprising ammonia, ammonium sulfite, ammonium sulfate, and water, and

having a pH between 6 and 8.

8. The process of claim 1, wherein said aerosol removal means is a wet electrostatic precipitator.

9. The process of claim 1, wherein said scrubbing step results in the formation of ammonium sulfate, the process further comprising the step of withdrawing ammonium sulfate from the scrubbing solution.

10. The process of claim 4, wherein said scrubbing step results in the formation of ammonium nitrate, the process further comprising the step of withdrawing ammonium nitrate from the scrubbing solution.

11. A process for removing SO_2, NO, NO_2, and Hg from a gas stream comprising the steps of

a. oxidizing at least a portion of the NO in a gas stream to NO_2, and at least a portion of the Hg in a gas stream to HgO, with an oxidizing means, followed by

b. scrubbing at least a portion of the SO_2, NO, and NO_2 from the gas stream with a scrubbing solution

comprising ammonia, and

having a pH between 6 and 8, and

c. removing at least a portion of any ammonia aerosols generated from the scrubbing step, and HgO, from the gas stream with an aerosol removal means.

12. The process of claim 11, wherein said oxidizing means is an electrical discharge reactor.

13. The process of claim 12, wherein said electrical discharge reactor is a dielectric barrier discharge reactor.

14. The process of claim 11, wherein said aerosol removal means is a wet electrostatic precipitator.

15. The process of claim 11, said scrubbing solution comprising ammonia, ammonium sulfite, ammonium sulfate, and water, and having a pH between 6 and 8.

16. The process of claim 15, wherein said scrubbing step results in the formation of ammonium sulfate, the process further comprising the step of withdrawing ammonium sulfate from the scrubbing solution.